CALCULATION AND VISUALIZATION OF MAP ROUTES USING QGIS AND PGROUTING SOFTWARE

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Recently, new tools have been created for working with geodata, which are used in various fields of human activity. Software for network analysis and routing solutions is of particular importance. The software product pgRouting is an example, distributed under the GPLv2 license. This program extends the capabilities of PostGIS / PostgreSQL geospatial databases. The article discusses the general principles of constructing routes on the graphs of the road network. It describes how to work with the geospatial database and the pgRouting software for building a route. The purpose of the work is to build a correct rout of a road graph in routing areas with a big number of objects and a poorly developed road network. The problem is solved by software pgRouting and QGIS on the basis of the Dijkstra shortest path algorithm, Johnson and Floyd-Warshall algorithms and allows you to solve the traveling salesman problem, and many others. The task is solved by means of software pgRouting и QGIS. As an experiment the article shows the solution for the task in which it is not enough to use only a road graph for building a correct route. Such situations may occur when routing the areas with a big number of objects and a poorly developed road network. In the process of the experiment described in the article it was found out that software pgRouting together with QGIS allows to rather effectively solve the task on calculation and visualization of the shortest route between two points on the map.

Keywords: routing, route, shortest path, graph, road network, geodata, visualization, geographic information system

REFERENCES

1. Geoportal of the spatial data infrastructure of the Russian Federation. (n. d.). Retrieved from http://nsdi.ru/geoportal/catalog/main/home.page [in Russian].

2. Dubrovsky, A. V. (2013). *Geoinformatsionnye sistemy: upravlenie i navigatsiya [Geoinformation systems: management and navigation]*. Novosibirsk: SSGA Publ., 96 p. [in Russian].

3. Karpik, A. P. (2013). Basic principles of the formation of geodesic information space. *Izvestiya vuzov. Geodeziya i aerofotos"emka [Izvestiya Vuzov. Geodesy and Aerophotosurveying]*, 4/S, 73–76 [in Russian].

4. Karpik, A. P. (2012). The current state and problems of geoinformation provision of territories. In *Sbornik materialov Interekspo GEO-Sibir'-2012: Plenarnoe zasedanie [Proceedings of Interexpo GEO-Siberia-2012: Plenary Session]* (pp. 3–8). Novosibirsk: SSGA Publ. [in Russian].

5. Order of the Government of the Russian Federation of August 21, 2006 No. 1157-p. About the Concept of creation and development of spatial data infrastructure of the Russian Federation Retrieved from http://base.consultant.ru/cons/cgi/online.cgi?req=doc;base=EXP;n=372580.

6. Shokin, Yu. I., & Potapov, V. P. (2015). GIS today: state, prospects, solutions. *Vychislitel'nye tekhnologii [Computational Technologies]*, *20*(5). Retrieved from https://cyberleninka.ru/article/v/gis-segodnya-sostoyanie-perspektivy-resheniya.

7. Kikin, P. M., & Khabibullin, R. R. (2017). Development of tools for calculating and visualizing cartographic routes based on pgRouting software. In *Sbornik materialov Interekspo GEO-Sibir'-2017: T. 2. Magisterskaya nauchnaya sessiya "Pervye shagi v nauke" [Proceedings of Interexpo GEO-Siberia-2017: Vol. 2. Master's Scientific Session "First Steps in Science"]* (pp. 63–66). Novosibirsk: SSGA Publ. [in Russian].

8. Yandex maps: routing technologies. (n. d.). Retrieved from https://company.yandex.ru/technologies/routes/ [in Russian].

9. Rigs, C. (2013). *Administrirovanie PostgreSQL 9 [Administration of PostgreSQL 9]*. Saint Petersburg: Piter Publ., 368 p. [in Russian].

10. Worsley, J., & Drake, J. (2003). *PostgreSQL dlya professionalov [PostgreSQL for professionals]*. Saint Petersburg: Piter Publ., 496 p [in Russian].

11. Drozdov, A. Yu. (2015). Solving problems of network analysis using PostgreSQL/PostGIS. In *Sbornik materialov Mezhdunarodnoy nauchno-prakticheskoy konferentsii: "Stroitel'stvo i arkhitektura – 2015". Sovremennye informatsionno-ekonomicheskie tekhnologii: tendentsii i perspektivy razvitiya [Proceedings of the International Scientific and Practical Conference: "Construction and Architecture-2015". Modern Information and Economic Technologies: trends and Prospects of Development]* (pp. 71–72). Rostov on Don: Rostov State University of Civil Engineering Publ. [in Russian].

12. Ermolaev, N. R. (2018). The use of QGIS software in the preparation of cartographic materials. In *Tezisy dokladov XXV Mezhdunarodnoy nauchnoy konferentsii studentov, aspirantov i molodykh uchenykh: Lomonosov-2018 [Abstracts of the XXV International Scientific Conference of Students, Postgraduates and Young Scientists: Lomonosov-2018]* (pp. 250–251) [in Russian].

13. Pashkovskaya, O. V., Novoselov, O. V., & Potapenko, I. A. (2020). Analysis of data in the geoinformation system QGIS. In *Sbornik materialov XXIV Mezhdunarodnoy nauchno-prakticheskoy konferentsii, posvyashchennoy pamyati general'nogo konstruktora raketno-kosmicheskikh sistem akademika M. F. Reshetneva: Ch. 2. Reshetnevskie chteniya [Proceedings of the XXIV International Scientific and Practical Conference dedicated to the memory of the General Designer of Rocket and Space Systems Academician MF Reshetnev: Part 2. Reshetnev Readings]* (pp. 345–346). Krasnoyarsk: Reshetnev Siberian State University of Science and Technology Publ. Retrieved from https://reshetnev.sibsau.ru/page/materialykonferentsii [in Russian].

14. Installing extension modules for QGIS. (n. d.). Retrieved from http://gis-lab.info/qa/qgis-install-plugin.html [in Russian].

15. Hritankova, A. A., & Kovalchik, N. V. (2020). Comparison of the capabilities of the software tools ArcGIS and QGIS for network analysis in the field of transport logistics (on the example of Minsk). In *Sbornik materialov respublikanskogo nauchno-prakticheskogo seminara studentov i molodykh uchenykh: GIS-tekhnologii v naukakh o Zemle [Proceedings of the Republican Scientific and Practical Seminar of Students and Young Scientists: GIS Technologies in Earth Sciences]* (pp. 9–13). Minsk [in Russian].

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